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named "philosophy" is to be superstitiously loyal to a name. But if names are to be used eulogistically, rather let us give that of philosophy to the fuller kind of knowledge, the kind in which perception and conception mix their lights.

As one who calls himself a radical empiricist, I can find no possible excuse for not inclining towards Bergson's side. He and Bradley together have confirmed my confidence in non-"transmuted" percepts, and have broken my confidence in concepts down. It seems to me that their parallel lines of work have converged to a sharp alternative which now confronts everybody, and in which the reasons for one's choice must plainly appear and be told. Be an empiricist or be a transconceptualist, whichever you please, but at least say why! I sincerely believe that nothing but inveterate anti-empiricist prejudice accounts for Mr. Bradley's choice; for at the point where he stands in the article I have quoted, I can discover no sensible reason why he should prefer the way he takes. If he should ever take it into his head to *revoke,* and drop into the other valley, it would be a great day for English thought. As Kant is supposed to have extinguished all previous forms of rationalism, so Bergson and Bradley, between them, might lay post-Kantian rationalism permanently underground.

WILLIAM JAMES.

HARVARD UNIVERSITY.

THE DURATION OF ATTENTION, REVERSIBLE PERSPECTIVES, AND THE REFRACTORY PHASE OF THE REFLEX ARC

IT would seem that one of the most assured conclusions of psychological research is about to be surrendered. The doctrine of the intermittent character of attention is proving to be only an "idol of the cave." Recent experiments on touch, electrical stimulation, and vision indicate that there is no fluctuation in the sensation if care is taken to exclude distracting stimuli, movements, twitching, etc.

The weak point in the old experiments, and in some of the new ones, is that only minimal stimuli can be employed—the weakest sounds, pressures, grays, electrical stimulations. Besides, the intensity of these can not always be kept uniform. It is rather curious, therefore, that most, if not nearly all, of the recent discussions of the question have entirely overlooked the contributions which the experimental study of reversible perspective illusions has already yielded, and the effective contributions which their study under improved experimental conditions promises to yield toward the solution of this question. In these illusions we have stimuli which undergo the same process of fluctuation as pressures, sounds, or brightnesses. But while the fluctuation in the case of the latter is not readily noticed unless the stimuli are so weak as to disappear entirely, or almost entirely, in one phase of the intermittence, with reversible illusions we can work with stimuli of almost any intensity. That the reversions are quite independent of the intensity of the stimulus is a matter of common observation. But it has also been subjected to experimental test. In a series of experiments upon various reversible figures (drawings) it appeared that a maximal intensity is even better than a minimal. Thus a white drawing on a black ground (where accordingly there is a maximal brightness of the lines) is preferred to the opposite arrangement, because the reversions are more clearly and readily perceived.[1] With the drawings placed at three distances from the eye, four, fifteen, and thirty-six inches, the middle distance, corresponding to the normal reading distance, was preferred by most observers, because it yielded clearer and less ambiguous perceptions. The one observer who preferred the greater distance did so for the same reasons. Here, then, intensity of sensation rather furthers than hinders the fluctuation. This would seem to contradict the results of Schröder, Sinsteden, Mohr, and others, who found a certain "unclearness," or "obscuration of details" essential for many reversions. It will be found, however, that this applies to reversions of tridimensional objects in which, if the binocular details were perfectly obvious, no reversions at all would occur.

What, now, are some of the aids and suggestions offered by the study of these illusions to the solution of the question of the intermittence of attention?

If the reversions were due solely to the fluctuation of attention it would seem that the perception of one of the perspectives should be weaker than the other. Specifically, the anomalous or non-predominant perspective (which it is found practically all figures possess) should appear less distinct than the predominant. It should appear somewhat hazy. But experiments show that it comes to consciousness with the same clearness, primacy, coerciveness, and spontaneity as the predominant.[2] The only blurring observed in my own case was during the moment of reversion. This occasional blurring, which did not affect the clearness of the supervening perspective, would point to some important physiological change as its cause.

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[1] Wallin, "Optical Illusions of Reversible Perspective," 1905, pp. 154, 156, 158, 260 f.

[2] *Op. cit.*, pp. 289, 310.

That this change does not appear to reside in the lens or the ciliary muscle appears from Loeb's and my own experiments upon subjects whose muscles of accommodation had been temporarily paralyzed. On the other hand, numerous experimenters (Sinsteden, Necker, Loeb, Hoppe) have experienced sensations, usually sensations of a sudden movement or twitching, simultaneous with the reversion. In my own case these sensations were quite prominent in reversing a tridimensional loop.[3] In another series with skeleton models the sensations were found to differ for the two eyes, and for different fixations.[4]

Moreover, Loeb and Wundt have both observed that eye movements increase the instability of the figure, and I frequently observed that the tendency of a drawing to become flat after being steadily regarded for some time could be largely counteracted by eye movements. Loeb also noticed that when one eye was screened it was seen to move at the moment of reversion. In an experiment with momentary exposures, lasting .03 sec., I had hoped to exclude the movement factor, but it appeared from the introspections that half of the observers were conscious of the fact that the eye swerved or dropped or tended to exploit the figure. Even if these movements or movement tendencies did not occur until after the exposure they would probably exert some influence upon the after-image, and since this behaves like the primary impression, the resulting sensation or perception would necessarily be modified.

If we may assume, as Gordon did, that a more complex figure holds the attention longer, the case for attention is not helped; for in my own series of experiments the simplest drawing reversed the slowest.[5] It reversed the slowest because it offered less motives for eye movements.

With these presumptions in favor of a peripheral explanation of the fluctuations (as due to instability of the eyes) it would be well if one of our psychological laboratories would attack the problem anew with the greatly improved forms of apparatus which now exist for the accurate recording of eye movements. From such records it should now be possible to ascertain whether eye movements invariably coincide with the period of reversion, or whether they precede or follow it, or occur quite independently of the reversion.

At the same time, it is quite doubtful whether an explanation in terms of eye movements (once they have been indubitably established) will tell the whole story, as indicated by the following considerations.

[3] *Op. cit.*, p. 26.

[4] *Op. cit.*, pp. 241, 242, 263.

[5] *Op. cit.*, p. 254.

In another experiment[6] in which the time of the perspectives in my own case was found to be 1.97 sec. for the non-predominant and 3.30 secs. for the predominant, it appeared that the time of the fluctuations for the reversible illusions corresponded with my efficiency curve, which in turn corresponded with the respiratory and Traube-Hering blood pressure undulations, as measured by Pillsbury.[7] Likewise Bonser found a similar correspondence by comparing parallel plethysmographic and sphygmographic tracings with the reversions of a pyramid. The crest of the "attention wave," as he viewed it, corresponded with the valleys in the blood pressure curve. So it seems that there is a connection between the fluctuations and the Traube-Hering blood pressure oscillations.

With these facts at my disposal the conclusion followed that the explanation of the so-called fluctuations of attention observed in reversible illusions and other stimuli has a common twofold ground: certain disturbances in the peripheral organ and certain bodily cycles, notably the blood pressure rhythm, possibly the respiratory rhythm, and possibly the cortical cell fluctuations. The fluctuations are thus simply the psychical correlates of bodily processes of fatigue and recuperation. The predominant perspective, which is the most stable and the easiest to envisage, represents the resting or recuperating period.

Latterly it has seemed to me that some of the more recent investigations[8] in neurology may throw some light upon the problem, especially studies of the reflex arc conduction. The laws which govern the reflex arc will apply, it would appear, to the stimuli under consideration.

In distinction from the nerve trunk, the reflex arc shows a latent time, which, according to Sherrington, has its seat in the gray matter of the synapsis; and a response which is rhythmical in character. The fluctuations vary from 7.5 to 12 per second in the flexion reflex (the rate given by Schäfer is from 10 to 12), irrespective of the nature of the stimulation. The periods are thus fixed within limits. The rhythmical reflexes show periods of excitation and refractory states. These refractory states—periods when the mechanism manifests lessened excitability—are an essential part of most reflexes. They are found in the nerve fibers, once a second, in the flexion reflex of the spinal dog (2.3 per sec.), the cross-stepping reflex in the spinal dog (2.5 per sec.), in the scratch reflex (4.5 per sec.), the reflex movements of swallowing in the narcotized cat (2 per sec.), and eye reflexes. With the latter it is found that the chances of a stimulus releasing a reflex is 50 per cent. less for one second during the refractory phase than one second later. The refractory phase is longer for visual than tactual and thermal stimuli, and is about the same for weak and strong stimuli (4.5 as against 5.8 per second). It sometimes lasts six times as long as the "period of activity" (Sherrington).

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[6] *Op. cit.*, pp. 245 f.

[7] Pillsbury, "Attention Waves as a Means of Measuring Fatigue," *American Journal of Psychology*, XIV., 1903, Table IV.

[8] Admirably summarized in Sherrington, "The Integrative Action of the Nervous System," 1906.

It would thus seem that the fluctuations which we observe in reversible illusions (or with faint gray rings or sounds) are the psychic correlates of the rhythmical and refractory phases of the reflex arc. The fact that the refractory phase differs for visual, tactual, and thermal stimuli accords well with the differences in time which have been found in psychological laboratories on fluctuations for the corresponding stimuli. The fact that there is a variation in the rhythm, or time of the refractory phase, of the reflex arc, within certain limits, accords with similar variations observed in psychological experiments on fluctuations. The fact that the refractory phase, which represents a period of lessened efficiency, a fatigue or recuperative period, is longer (sometimes six times) than the "period of activity," accords well with the measurements of reversible illusions, in which it was found that the one perspective lasted longer than the other, and in which it was inferred that, since it was the normal, predominant perspective which was the most stable, this was a period of recovery.[9] The fact that the time of the refractory phase is almost constant under weak or strong stimulation finds a parallel in these illusion fluctuations. Furthermore, the refractory phase varies with conditions of fatigue, practise, and the use of certain drugs. Likewise in one series of experiments with skeleton models practise made itself manifest in a shortening of the time needed to reverse of from 25 to 50 per cent., and in a special practise experiment the percentage of successes in the second half was nearly twice that of the first half. Effects of fatigue appeared in another experiment, where the slowing of the reversions in the second half affected especially the predominant perspective, which would correspond with the recuperative or refractory period of the reflex arc.

It would therefore appear that further control experiments on these illusions under conditions of decided general fatigue and under the influence of strychnine (which seems to convert inhibition into excitation, producing quickened reactions, sometimes eventuating in a condition of tetanus) should offer a fruitful method of solving the problem—by some one with the ingenuity to perfect a sufficiently refined experimental procedure.

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[9] Wallin, *op. cit.*, p. 253.

J. E. Wallace Wallin.

Cleveland Normal Training School.

SOCIETIES

THE NINTH ANNUAL MEETING OF THE AMERICAN PHILOSOPHICAL ASSOCIATION

THE Yale sessions of the Association on December 27, 28, and 29 last were more than ordinarily successful from first to last. Though regrets were heard that the philosophers had encamped far from the psychologists in Boston, nobody seemed to take it much to heart, for the attendance was fully up to the normal, if not above it. Considering the inevitable diversity of themes, the papers were admirably grouped, so as to permit those of a session being discussed together; this was particularly true of the second session and somewhat less so of the first. Partly because of this good management by the executive committee and partly by reason of the absence of other distracting scientific meetings, the general interchange of criticism and opinion became conspicuously full and lively; and yet the burden of responsibility for this stimulating outcome lay elsewhere. It was the sharpening of questions and the concentration upon two of these that told most. Of the fourteen papers read on Monday and Tuesday, seven may fairly be described as having focused, more or less clearly, upon methodology, in its widest sense. Three of these seven, three of the remaining other seven and the three leading papers on Wednesday morning pitted realist against idealist in a series of encounters lacking nothing of briskness. Most striking and singular—what, too, must have puzzled the laity who attended the sessions—was the invisibility of pragmatist badges and the almost unbroken silence on those topics pragmatic with which reading-room gossip has identified the new movement. Save in one or two addresses, which were explicitly historical or classificatory, not so much as the name appeared. In reality, though, it had vanished only from the surface of events; its "isms" had evaporated, along with looser first generalities from its nascent stage, but its spirit lived at a deeper level in the arguments of the realists. Their reiterated insistence upon the necessity of facing concrete situations and solving them on the basis of consciously accepted, definite, well-narrowed presuppositions was but the practising, rather than the preaching of pragmatism. This attitude